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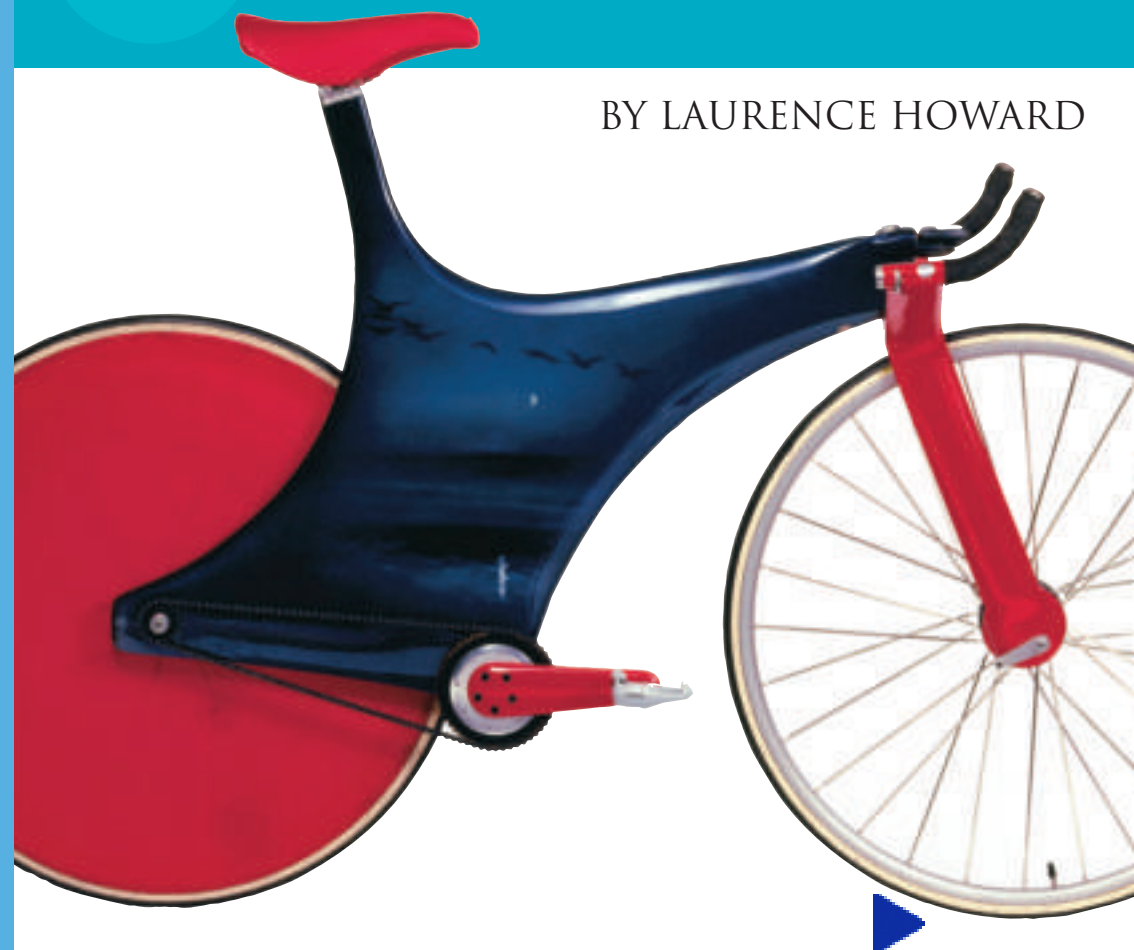
Science

Physical Science



THE WHEELS ON THE BIKE GO ROUND AND ROUND

BY LAURENCE HOWARD



Genre	Comprehension Skills and Strategy	Text Features
Expository nonfiction	• Generalize • Main Idea and Details • Ask Questions	• Table of Contents • Captions • Labels • Glossary

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THE WHEELS ON THE BIKE GO ROUND AND ROUND

BY LAURENCE HOWARD



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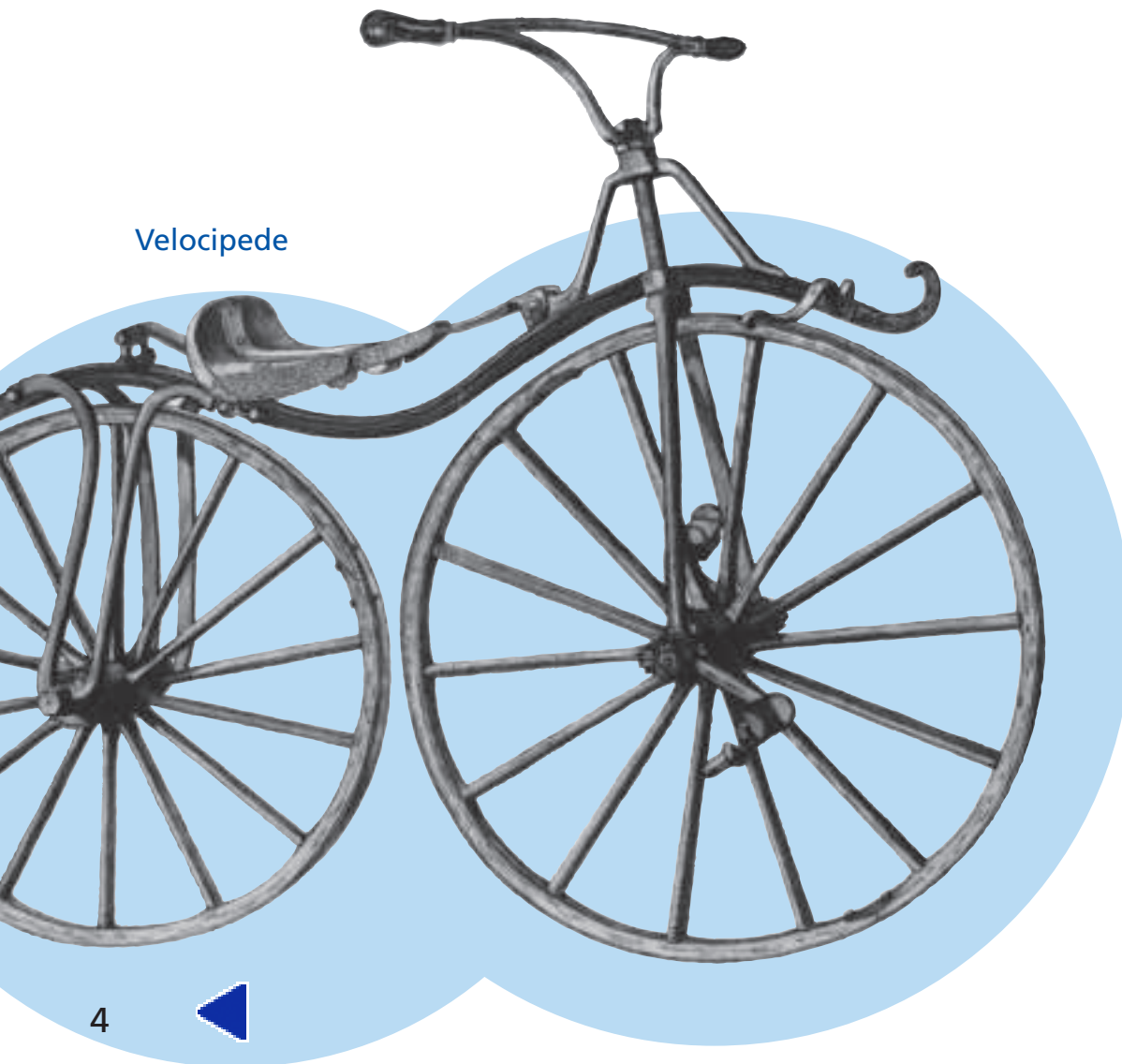




Chapter 1 *Early Bicycle History*

The wheel was invented more than five thousand years ago, when people realized they could move heavy objects by rolling them over something round. Later on, people discovered they could move themselves on wheels too. Before the invention of what we know today as the bicycle, people created many different versions of self-moving vehicles.

Velocipede



In 1817, a German nobleman named Baron Karl von Drais created the *draisienne*. Von Drais's invention had two wheels, and the front wheel could be turned left or right. The *draisienne*, or *hobbyhorse*, was made of wood and could only move when the rider walked or ran. It was also known as the running machine.

When pedals were attached to the front wheel of a hobbyhorse, the *velocipede* was born. Can you see why the word *velocipede* means “fast foot”?

Because it provided a very bumpy, bouncy ride, the velocipede was also called the “boneshaker.” At the time, streets were made of cobblestones, and the hobbyhorse had wood and iron wheels. Ouch! Back when this great-grandfather of the bicycle was popular, indoor tracks were created so people could ride without serious injury.

In the early 1870s, after people had become tired of the boneshaker, English cycle makers introduced a bicycle with steel rims, solid rubber tires, and a front wheel that was much larger than the back one. Why? Making one turn of the pedals equaled one circle of the front wheel. The larger the front wheel, the farther you could travel on one turn of the pedals.





One problem with these high-wheeled bicycles, or *high wheelers*, was the danger of falling off. They were built to be fast, not safe. The rider sat high off the ground on a seat over the large front wheel, and some front wheels were over five feet tall. Just getting on and off was a real challenge, and to be safe, they needed a very smooth road. Even a pebble or small pothole might cause the rider to lose control and fall head over heels. High wheelers also had spokes, which gave support to lighter types of wheels, making them as strong as heavier wheels.

The next advance in the development of bicycles was the introduction of **pneumatic** tires—rubber tires filled with air under pressure. These tires provided bicyclists a much smoother, more comfortable ride than just hard wood or metal.



This unusual high wheeler had a large rear wheel.



Spoke →



Finally, in 1885, science and inventive creativity produced the *safety bicycle*. This new invention had two same-sized wheels that reduced the chance of falling off, and also had pedals that were connected to the rear wheel by means of gears and a chain. This was different from earlier bikes, which had their pedals connected directly to the front wheel. On the high wheeler, the size of the wheel controlled the speed of the bicycle, but on a safety bicycle, the speed was controlled by the difference in size between the two gears.



The safety bicycle's two equal-sized wheels made it easier and safer to ride than the high wheeler.



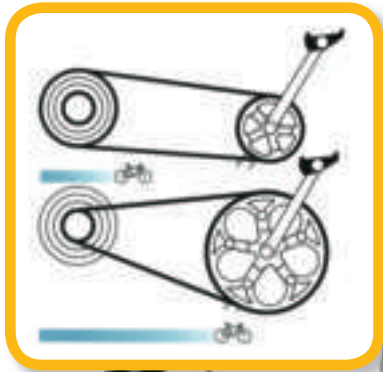
SAFETY FOR LADY OR GENT. REMOVE BAR
FOR LADY. STRICTLY HIGH GRADE.





Chapter 2 *Modern Bicycles*

By 1910, an important invention had been created, called the *derailleur*. This device allowed the rider to choose different combinations of front and rear gears. Different combinations of gear sizes allowed the rider to travel at any speed while pedaling at a comfortable rate. A large front gear combined with a small rear gear would make the bike go fast, and a small front gear combined with a large rear gear would make the bike go slowly. Modern racing bicycles and mountain bicycles often have twenty or more speeds.



At the beginning of the twentieth century, the safety bicycle became popular throughout the United States and around the world. Factories produced bikes in huge quantities. As their prices fell, average workers could afford them. People joined biking clubs, and bike races became popular.

The bicycle craze slowed down with the rise in popularity of the streetcar and other mass transit systems, and for many years following the 1910s, bicycles were thought of as children's playthings. Over the next few decades, major improvements in bicycles consisted of making them lighter and stronger, and providing better ways to switch gears.

Worries about air pollution, physical fitness, and the cost of gasoline gave bicycles a new popularity with adults in the 1960s, '70s, and '80s. In 1984, seventy-six million bicycles were sold in the United States, an amount more than double the thirty-one million

automobiles sold that year. Bikes have become so popular that a whole world of activities has developed around them.

There are many bicycling clubs in the world, and there are many kinds of bicycles.



In the late 1900s, bicycles grew in popularity.



Interest in bikes encouraged inventors to create many new types of bicycles, and mountain bikes were created in the 1970s. They are made with fat tires, which rarely go flat and help the bike move faster on dirt trails. Treads, or deep grooves in the tires, help the bicycle grip the terrain. Mountain bikes also have strong, heavy frames to match the rough mountain environment on which they are made to travel. They usually have comfortable seats and twenty-seven speeds.

Track-racing bikes have a very light frame, and their tires are made to grip the track. They have no brakes, light wheels that only move when the pedals are moved, and handlebars that are set low to reduce the **force** of air. When the rider sits low to the handle bars, it reduces **drag**—which is caused by air pushing against a surface area—the smaller the area, the less drag. Drag slows down a bike's movement.

A bicycle called a BMX (Bicycle Motocross) is made to race on dirt roads and to do tricks and stunts. BMX bikes are lightweight and have few parts, their wheels are tiny to keep their weight low, and BMX bike frames are designed to survive falls and crashes. For safety, BMX bikes usually have more than one kind of brake, for slowing down quickly and preventing accidents.



Track-racing bike



BMX bike



Road bikes



Road bikes are designed for speed, and they are faster than any other bicycle. Because of their speed, professional bike racers use road bikes, but they are also fine for just riding around the neighborhood. They have very light frames, a thin seat, ten or more speeds, and extremely thin, but incredibly strong, tires that rarely slip or slide, even in the rain.





Recumbent bike

Tandem bike



Hybrid bikes combine some of the features of mountain bikes and road bikes. For example, they have the comfortable seats of mountain bikes and the narrow tires of road bikes. Their frames are stronger than those of road bikes, but they are not as heavy as the ones used for mountain bikes. Hybrid bikes are used on streets and solid trails, and most hybrids have twenty-one or more possible speeds.

Recumbent bicycles let the rider sit in a position that is halfway between sitting and lying down. They have comfortable, stuffed seats, and the pedals are placed forward, toward the front wheel rather than under the rider.



Two-wheelers that are made especially for children normally have one speed and coaster brakes. Coaster brakes work by firmly pedaling backward, which creates **friction** on the rear wheel. Friction is when two surfaces rub together. A braking device inside the wheel hub, or the center of the wheel, creates drag on the wheel, causing the bike to stop.

There are also bicycles built for two riders called tandem bikes. They have two seats, two sets of handlebars, and two sets of pedals; and they are available in the styles of mountain, hybrid, road, and recumbent bikes.





Chapter 3 *Bicycle Science and Superstars*

If you want to understand what makes a bicycle work, you need to know about **motion** and force. Motion is another name for movement, and force is something that causes an object to be pushed or pulled. Speeding motion up is called **acceleration**. This happens when you pedal faster and faster on your bike. Slowing down motion is called **deceleration**—this can happen when you stop pedaling, or when you apply the brakes.

Isaac Newton, a mathematician and physicist, figured out how motion works, and he broke it down into three rules called the laws of motion. The one we will concentrate on is Newton's first law.



Wheel brake



Newton's first law of motion says that an object stays at rest until a force acts on it. Once a force acts on it and it starts moving, it keeps moving in the same direction until another force acts against it.

Many forces contribute to and oppose a bicycle's motion. As you know, the force that gets a bicycle accelerating, or moving, is pedaling, and the force that safely slows down and stops a bike is the friction caused by braking. Using hand brakes on a bicycle pushes a rubber pad up against the side of the tire, and this friction makes the bike come to a stop.

Also, the tire's ability to push against the ground without slipping is called **traction**. Traction is the sticking friction of an object on a surface on which it is moving. The tire grips the road so the bicycle can move forward, but if the road is too rough it can create too much friction, which can slow down or stop a bicycle.

Drag, as you read earlier, is a force that slows down motion, and drag is caused by air pushing against you and the bicycle as you move. If you were biking up a hill with the wind in your face, for example, drag would slow you down, and another force that would slow you down would be gravity. When biking down the hill, however, the pull of gravity would help you speed up.



Gravity and pedaling would cause *acceleration* downhill. Drag from the air and friction from the wheel brake would cause *deceleration*.



Two of the greatest bicycle racers of all time are Marshall “Major” Taylor and Lance Armstrong. Both had to overcome severe difficulties in their efforts to be champions.

Born in 1878 in Indiana, Marshall Taylor was African American, at a time when African Americans were not given the same opportunities as white people. Luckily, Marshall received a bicycle from a friend, and before long, cycling was his favorite activity. By watching experts, he taught himself bike tricks and quickly became an expert at bike tricks himself.

Soon, Marshall started entering bicycle races, and a bike shop in his town paid for some of his equipment and expenses. Marshall liked to wear an army uniform with lots of military decorations on it, and that is why people started to call him “Major.”

Marshall Taylor won national sprint races in 1899 and 1900. A sprint is a short, fast race. By 1901, everyone thought of him as the world champion bicycle sprint racer, and fans from many countries admired Major Taylor. His champion performances and the records he set made it easier for other African Americans to become professional athletes in the United States.



Marshall “Major” Taylor





As of 2005, Lance Armstrong had won seven Tour de France bicycle races in a row. The Tour de France is a three-week bicycle race that covers two thousand to twenty-five hundred miles, mostly in France.

Armstrong was born September 18, 1971, and he grew up in Plano, Texas. Encouraged by his mother to get involved in sports, Armstrong became a professional triathlete when he was just sixteen. In a triathlon, athletes compete in a contest of swimming, bicycling, and running. When Armstrong finished high school, he decided to concentrate only on cycling. His practice rides were so long that when he finished, his mother had to come with her car to pick him up.

The first summer after Armstrong finished high school, he qualified for the 1989 junior world championship cycling race held in Moscow, Russia. In 1991, he won the United States **amateur** cycling championship, and he participated in the 1992 Olympics.

Through hard training, Armstrong has become one of the world's best cyclists. In 1993 he won ten championships, and also began to share his success with others by starting a junior racing program for kids.



Lance Armstrong in the 1996 Olympics (left) and the 2004 Tour de France (below)



Three years later, medical tests showed that Armstrong had cancer. He required two operations, and doctors only gave him a 50 percent chance of getting well. Fortunately, medical treatment helped Armstrong beat his illness. Only five months after Armstrong was told he had cancer, he was back training on his bicycle!





Many people thought Armstrong's illness would leave him too weak to win races, but he did not let that slow him down, and he did not give up. Despite having to endure months of painful medical treatments, Armstrong came back to win race after race, including the Tour de France, the most important race in cycling.

As you have learned, the bicycle has come a long way since the creation of running machines, which didn't even have pedals, and high wheelers, which were highly dangerous. Comfort, safety, and science have played important roles in the development of self-moving vehicles. As interest in bicycles grew, inventors built many different kinds of them to suit a range of interests, abilities, and terrains. Cyclists can take to the roads, the race tracks, the mountains, and more with the specialized bikes of today.

What kind of bike have you used before? What kind of bike do you own, or what kind of bike would you like to have? Did you learn about new varieties of bicycles that might be of interest to you, now that you have read this book? As you can see, the bicycle is a great invention to use for traveling, for sport, and for fun.



A hobbyhorse from the 1800s (top)
and modern BMX racing (bottom)





Now Try This

Spread the News About Biking

Using the Internet, the library, and any other sources you can think of, do a careful exploration of cycling organizations and activities that exist in your area. Include stores or catalogs that sell anything having to do with cycling.

Don't forget to find out what arrangements your local government has made to meet the needs and protect the safety of cyclists. There may be special bike trails or paths that have been set aside for cyclists.

Often, there are biking laws and other rules about where people may cycle, how cyclists must behave, what they must wear while they are cycling, and how automobile drivers must act around cyclists.



The Internet is a treasure trove of information about bicycles.



Here's How to Do It!

1. Gather together materials to make a poster. What colors and materials will you use to grab people's attention?
2. Using the information you have found, make a poster advertisement that would be useful to bicycle lovers who have just moved to your city or town. Organize the poster's information clearly and in a way that is easy for people to read and understand.
3. Your advertisement will show newcomers and other cyclists what is available to them. Perhaps you could get permission to hang your poster at your school, or somewhere in your community, for people to see and use.





Glossary

acceleration *n.* the act of speeding up.

amateur *adj.* not done for money or as a profession.

deceleration *n.* the act of slowing down.

drag *n.* the force acting on an object in motion, in a direction opposite to the object's motion.

force *n.* energy or power that may cause, change, or stop the motion of an object.

friction *n.* resistance to motion of two moving objects or surfaces that touch, or the act of rubbing one thing against another.

motion *n.* movement.

pneumatic *adj.* filled with air.

traction *n.* ability to push against a surface without slipping.



Reader Response

1. Make a general statement describing what bicycles were like in the 1800s.
2. What questions do you have about the forces of motion that act on a bike? Where can you find the answers to your questions? Write your questions and answers in a chart similar to the one below.

Questions	Answers

3. One of the vocabulary words is *pneumatic*. Use a dictionary to find at least one other word that starts with *pneum*. How are these words related?
4. Look at the different bicycles on pages 11 through 13. How are they the same? How are they different?

